9/83

# LORAIN

## POWER EQUIPMENT

LORAIN MODEL HSB8B

DC TO DC CONVERTER

Spec. No. 5653-027 Serial No. _____

# INSTRUCTIONS

## INSTALLATION
## OPERATION
## MAINTENANCE

RELIANCE COMM/TEC

LORAIN MODEL HSB8B

DC TO DC CONVERTER

Spec. No. 5653-027 Serial No. _____

**LORAIN PRODUCTS**
**Division of Reliance Electric Co.**

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Seller warrants that the products it manufactures or sells shall be free from defects in material and workmanship during the first 90 days after the product is activated. During said period, Seller will repair or replace any defective parts free of charge to Buyer, including any labor costs. In addition, Seller shall repair or replace any defective parts, so discovered by Buyer to be defective within two years from the date of shipment of same, provided Buyer promptly so notifies Seller. In no case shall Seller's liability under this warranty extend beyond two years from the date of shipment of said product. This warranty shall not apply to any products which are misused, modified, repaired, or otherwise abused by Buyer or others. The repair or replacement of defective parts, or the refund of the invoice cost thereof, as shall be determined by Seller in its sole discretion, shall be the limit of Seller's liability hereunder and shall be Buyer's sole and exclusive remedy.

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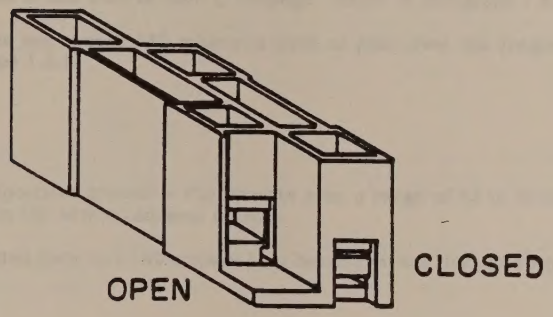
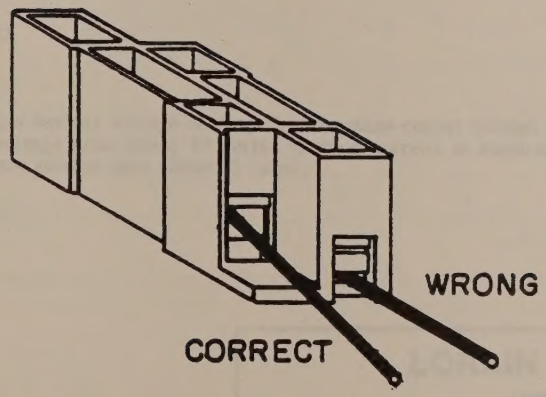
## WARNING

When making electrical connections, assure that the wire is properly inserted between the metal clamps of the terminal (see sketch). Inserting the wire under the lower clamp of the terminal creates a potential fire hazard.



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RELIANCE COMM/TEC

# 1. SPECIFICATION

1.1 **GENERAL:** This DC to DC Converter changes 48 volts DC (positive ground) to 48 volts DC for either positive or negative grounded systems.

1.2 **OUTPUT RATINGS**

1.2.1 **Voltage:** Negative or positive 48 volts DC nominal. Adjustable over the range of 45.6 to 50.4 volts.

1.2.2 **Regulation**

(A) **Static:** Steady state output voltage remains within ± 1% of the adjusted voltage for any load current from no load to full load for the input voltage range of 42 to 56 volts DC.

(B) **Dynamic:** For a step load change of 50% of full load within the range of 10% to 100% of full rated current, the maximum voltage transient will not exceed 5% of the initial steady state voltage. Refer to paragraph 1.8.1.

1.2.3 **Filtering**

(A) **Voice Band:** Noise is less than 26 dBrn C message. Refer to paragraph 1.8.1.

(B) **Wide Band:** Does not exceed 480 millivolts peak to peak over the frequency range of 10 Hz to 50 MHz. Refer to paragraph 1.8.1.

1.2.4 **Current:** 8 amperes

1.3 **INPUT RATINGS**

1.3.1 **Voltage:** 48 volts DC (positive ground) - Will operate over a range of 42 to 56 volts DC. Converter will tolerate a range of 40 to 60 volts DC with no adverse effects.

1.3.2 **Filtering:** Noise reflected back to a 100 ampere hour battery is less than 26 dBrn. Refer to paragraph 1.8.1.

1.3.3 **Typical Input Currents**

(A) **No Load:** 0.43 amperes at 48 volts DC

(B) **Full Load:** 9.6 amperes at 48 volts DC

(C) Does not exceed 12 amperes at maximum overload with the input voltage within the range of 42 to 56 volts DC.

1.4 **STANDARD FEATURES**

1.4.1 **Input Protection**

(A) **Undervoltage:** Low battery voltage sensing circuit causes output voltage and current to be reduced to zero when the input voltage goes below 37 volts. Output current is automatically restored up to maximum overload when input voltage goes above 42 volts.

| ISSUE | CHG. NO. | DESCRIPTION |
|---|---|---|
| 9 | 183-7504 | BP DEC 9 1982 DD 12-9-82 ADDITIONAL WIRE ACCESS HOLE ADDED. |
| 8 | — | 18 1982 Reference to Shunt Output Diode JFS 1-18-82 deleted and paragraph 1.5.2 updated. |
| 7 | — | JUL 17 1980 PARA. 1.4.2 (B) QUALIFIED J.B.C. 7-11-80 |

REVISIONS

LORAIN PRODUCTS
LORAIN, OHIO
RELIANCE COMM/TEC

**POWER DATA**

MODEL HSB8B DC TO DC CONVERTER
SPEC. NO. 5653-027

| DR BY | DATE | GRP. LDR. | DATE |
|---|---|---|---|
| J. Carrion | 7-15-80 | D. Kammiller | 7-15-80 |
| CH BY | DATE | APP BY | DATE |
| J. Carrion | 7-15-80 | R. Kurish | 7-15-80 |
| ENGR BY | DATE | | |
| D. Kammiller | 7-15-80 | | |

PD-5653-027

# 1. SPECIFICATION

1.4.2 **Output Protection**

(A) **Short Circuit:** One 10 ampere Bussmann Type BAF fuse

(B) **Current Limiting:** Circuit limits DC output current to 110% of full load at nominal input.

(C) **Overvoltage:** Voltage trip circuit breaker and high voltage sensing circuit disconnects the input voltage when the output voltage exceeds 50.4 volts.

1.4.3 **Audible Noise:** Operating frequency beyond audible range.

1.4.4 **Meters**

(A) 0-75 volt, 2-1/2 inch rectangular type DC voltmeter, ± 2% accuracy at full scale, MODUTEC (or equivalent), 2.41 inch scale length.

(B) 0-15 ampere, 2-1/2 inch rectangular type DC ammeter, ± 2% accuracy at full scale, MODUTEC (or equivalent), 2.41 inch scale length.

1.4.5 **Series Output Diode:** Output diode, which enables paralleling with other converters, may be connected in either negative or positive lead. Load may not be shared proportionately between paralleled units. Failure in one converter will not affect the others.

1.4.6 **Alarms**

(A) If the output voltage exceeds a preset limit (factory set at 52.2 ± 0.4V), circuits cause two alarm circuits to close, ground to be made available for two alarm circuits, a CONVERTER FAIL lamp to light, and the converter to be turned off.

(B) If the input or output voltage goes below a prest limit (factory set at 37V for low input; 45.8 ± 0.4V for low output), or if the converter is manually turned off, circuits cause two alarm circuits to close, ground to be made available for two alarm circuits, and a CONVERTER FAIL lamp to light.

1.4.7 **Mounting:** Universal angle provided for either 19 inch (1-3/4 inch multiple drilling) or 23 inch (1 inch or 1-3/4 inch multiple drilling) relay rack mounting.

1.5 **ENVIRONMENTAL RATINGS**

1.5.1 **Operating Ambient Temperature Range:** 0° C to +50° C (+32° F to +122° F)

1.5.2 **Storage Temperature Range:** -20° C to +65° C (-4° F to +149° F)

1.5.3 **Heat Dissipation:** 268 BTU/HR (48 volt input at 50 volt output and full load)

1.5.4 **Ventilation Requirements**

(A) **Ventilation:** This converter should be mounted so that bottom and top ventilating openings are not blocked and air entering the bottom of the cabinet does not exceed +50° C (+122° F).

(B) **Spacing:** It may be necessary to allow a minimum of 1-3/4" spacing between this converter and other heat producing equipment.

(C) **Stacking:** A maximum of six converters may be stacked, one above the other, with 1-3/4" minimum spacing. Additional converters may be stacked provided a baffle plate or increased spacing is used.

1.6 **ACCESSORIES:** None

1.7 **MISCELLANEOUS**

1.7.1 **Schematic Diagram:** SD-5653-027

1.7.2 **Wiring Diagram:** T-5653-027

1.7.3 **Instructions:** Section 3441

1.8 **SPECIFICATION NOTES**

1.8.1 This parameter is guaranteed by Engineering Design. Parameter is not production tested.

# 2. DIMENSIONS

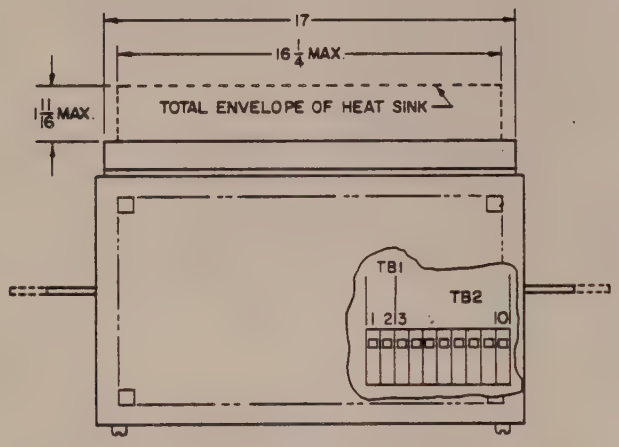



FIG. 3
TOP VIEW

NOTES

1. ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE SPECIFIED.
2. WEIGHT
   (A) SHIPPING: 28 LBS.
   (B) NET: 23 LBS.
3. FINISH: EQUIPMENT LIGHT GRAY.
4. INDICATES VENTILATING GRILLE

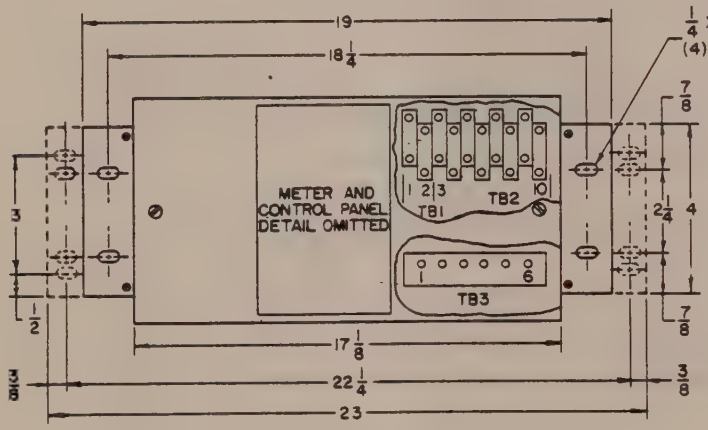



FIG. 1
FRONT VIEW

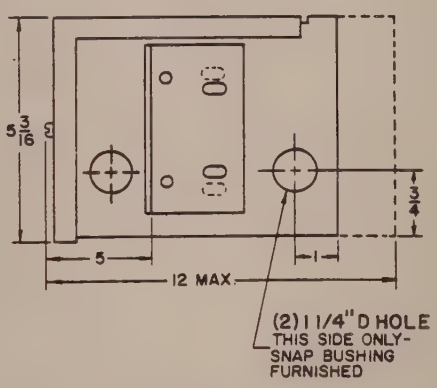
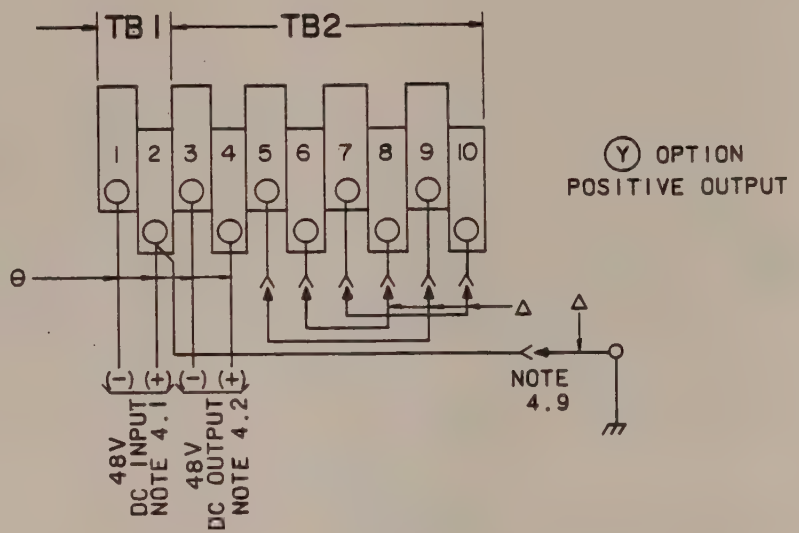
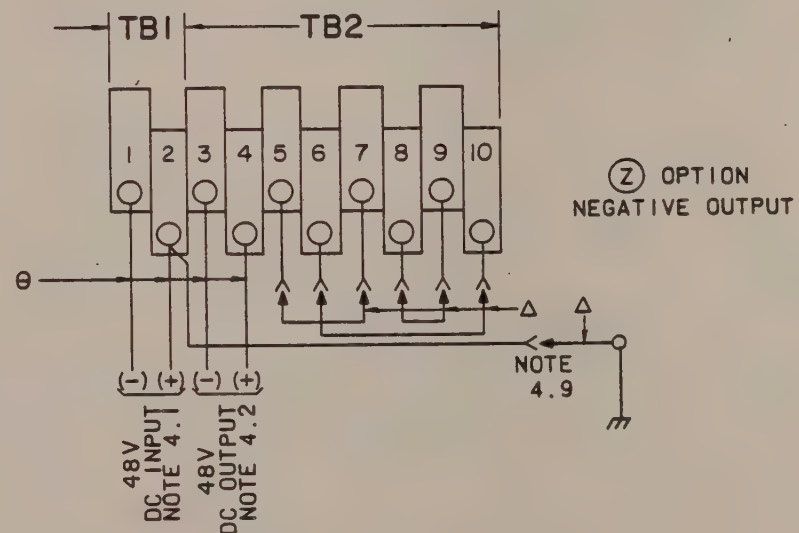
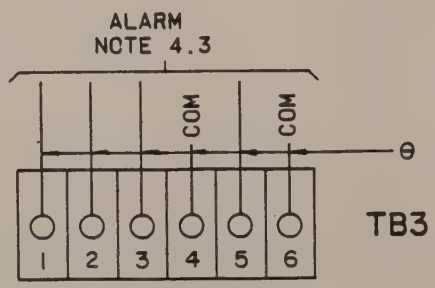



FIG. 2
SIDE VIEW

# 3. INSTALLER'S CONNECTIONS



# 4. INSTALLER'S INFORMATION NOTES

4.1

| DC INPUT (TB1) | | | | |
|---|---|---|---|---|
| Terminals | | | | |
| Capacity | Type | Loop Length - Ft | Recm Wire Size | Recm Fusing |
| 22 to 8 Ga. | Saddle Clamp | 50 | 12 Ga. | 15 amperes |
| | | 100 | 8 Ga. | |

4.2

| DC OUTPUT (TB2) | | | |
|---|---|---|---|
| Terminals | | | |
| Capacity | Type | Loop Length - Ft | Recm Wire Size |
| 22 to 8 Ga. | Saddle Clamp | 50 | 14 Ga. |
| | | 100 | 10 Ga. |

4.3

| ALARMS (TB3) | | |
|---|---|---|
| Terminals | | |
| Capacity | Type | Recm Wire Size |
| 16 Ga. Max. | 6-32 Screw | 18 Ga. |

4.4 DC wire sizes are sufficient to restrict the voltage drop to one volt or less at full rated current for the loop lengths shown. The loop length is the sum of the positive and negative leads.

4.5 Wire sizes meet those recommended in the 1978 National Electric Code Table 310-16 for +75° C conductor temperature.

4.6 Alarm condition causes circuits to close between terminals 3 to 4 and 5 to 6 of terminal block TB3. Ground is also furnished at terminals 1 and 2 of terminal block TB3.

4.7 Δ indicates wiring furnished with the converter to be installed by the customer.

4.8 Θ indicates wiring furnished and installed by the customer.

4.9 Positive ground to chassis provided by jumper. Removal optional after installation.

LORAIN PRODUCTS CORP.
Operating Methods and
Circuit Description

# "HSB" SERIES
# DC TO DC CONVERTERS

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## 1. MODEL DATA

### General

**1.01** Refer to the appropriate Power Data Sheet for information concerning the input and output ratings, operating limits, dimensions, recommended input and output lead sizes, fusing, and terminal lug capacity for the following DC to DC Converters:

| Model | Spec. No. |
|---|---|
| HSB3H | 5664-022 |
| HSB6H | 5664-023 |
| HSB8B | 5653-027 |
| HSB16A | 5635-007 |
| HSB16B | 5653-028 |
| HSB16B | 5653-030 |
| HSB30A | 5645-002 |
| HSB8A | 5625-003 |

## 2. DESCRIPTION

### General

**2.01** This DC to DC Converter operates from nominal 48 volts DC to provide filtered and regulated DC to the load. This Converter is a compact unit designed with a high frequency switching circuit to maintain audible noise levels to an absolute minimum.

**2.02** This Converter is equipped with a High Voltage Shutdown/Low Voltage Alarm circuit. In the event of a high output voltage condition, the Converter will shutdown; while a low output voltage condition will cause an alarm to be extended.

**2.03** A low battery sensing circuit causes output voltage and current to be reduced to zero when the input voltage goes below 37 volts. Output current capability is restored up to maximum rated load when input voltage goes above 42 volts.

**2.04** This Converter is also equipped with a current limiting circuit which will prevent further increase of output current above a preset (adjustable) level.

### Accessories

**2.05** An accessory for Model HSB16A (5653-007) is available for changing the output voltage adjustable range from 22.8 - 25.2 to 25.17 - 27.83. This option is designated "X" on Drawing SD-5635-0007.

**2.06** An accessory for Model HSB30A (5645-002) is available for changing the output voltage adjustable range from 22.8 - 25.2 to 20.0 - 24.0 volts. This option is designated "X" on Drawing SD-5645-002.

## 3. INSTALLATION

### Location

**3.01** This DC to DC Converter will operate best in a well ventilated area which has an ambient temperature range of 0° C (32° F) to 50° C (122° F).

### Mounting

**3.02** This Converter is designed for mounting in 19 or 23 inch relay racks.

> CAUTION: In mounted position, ventilation openings at the top and bottom of the Converter cabinet must be unobstructed. This is essential for proper cooling during operation. The temperature of air entering the cabinet must not exceed 50° C (122° F). Refer to Power Data Sheet for spacing and baffle plate requirements.

### Electrical Connections

**3.03** Installer's input, output, and alarm connection terminals are accessible by removing the front cover of the unit. The terminal blocks are located at the front right side of the unit. Installer connections are shown on the Power Data Sheet.

## 4. ADJUSTMENT

### General

**4.01** All adjustment potentiometers are located on the plug-in circuit cards at the front left side of the unit. To gain access to the plug-in circuit cards, it is necessary to remove the front cover of the Converter.

### Output Voltage Adjustment

**4.02** The output voltage adjustment potentiometer OUTPUT VOLTAGE (R3), located on circuit card VR-A3, sets the output voltage level of the Converter. Unless otherwise specified, the output voltage has been factory adjusted to the output voltage given in Table A. Should readjustment become necessary, follow the procedure given below.

a) Adjust the output votlage to the desired level by means of potentiometer OUTPUT VOLTAGE (R3). The output voltage can be monitored on output voltmeter M1.

b) To increase output voltage, turn the screwdriver adjustment shaft of potentiometer R3 clockwise; to decrease output voltage, turn the adjustment shaft counterclockwise.

### High Voltage Shutdown Adjustment

**4.03** The high voltage shutdown adjustment potentiometer HIGH VOLTAGE SHUTDOWN (R2), located on circuit card HVS/LVA, sets the value of output voltage at which the Converter will shutdown. Unless otherwise specified, the high voltage shutdown limit has been factory adjusted to the voltage given in Table A. Should readjustment become necessary, follow the procedure given below.

CAUTION

It may be necessary to disconnect the load from the Converter output to perform this adjustment, since the Converter

| Model & Spec. | Output Voltage Volts | Current Limit, % | High Voltage Shutdown, Volts | Low Voltage Alarm, Volts |
|---|---|---|---|---|
| HSB3H 5664-022 | 130 | 110 | 136-137 | 123-124 |
| HSB6H 5664-023 | 130 | 110 | 136-137 | 123-124 |
| HSB8B 5653-027 | 48 | 110 | 51.8-52.6 | 45.4-46.2 |
| HSB16A 5635-007 | 24 | 110 | 25-25.4 | 22.6-23 |
| HSB16A 5635-007 e/w "X" Option | 26.5 | 110 | 26.6-28.0 | 25-25.4 |
| HSB16B 5653-028 5653-030 | 48 | 110 | 51.8-52.6 | 45.4-46.2 |
| HSB30A 5645-002 | 24 | 110 | 25-25.4 | 22.6-23 |
| HSB30A 5645-002 e/w "X" Option | 22 | 110 | 22.9-23.3 | 20.7-21.1 |
| HSB8A 5625-003 | 24 | 110 | 25-25.4 | 22.6-23 |

TABLE A
FACTORY SETTINGS

will be shut off in the process.

a) Turn the screwdriver adjustment shaft of potentiometer HIGH VOLTAGE SHUTDOWN (R2) fully clockwise.

b) Increase the output voltage of the Converter to the desired shutdown value by turning clockwise the screwdriver adjustment shaft of potentiometer OUTPUT VOLTAGE (R3), located on circuit card VR-A3.

c) Turn the screwdriver adjustment shaft of potentiometer R2 counterclockwise until input circuit breaker CB1 opens.

d) Return potentiometer OUTPUT VOLTAGE (R3) to its original setting and close input circuit breaker CB1.

### Low Voltage Alarm Adjustment

**4.04** The low voltage alarm adjustment potentiometer LOW VOLTAGE ALARM (R1), located on circuit card HVS/LVA-A4, sets the value of output voltage at which the alarm circuits will illuminate lamp CONVERTER FAIL and activate an external alarm, if connected. Unless otherwise specified, the low voltage alarm limit has been factory adjusted to the value given in Table A. Should readjustment become necessary, follow the procedure given below.

a) Turn the screwdriver adjustment shaft of potentiometer LOW VOLTAGE ALARM (R1) fully counterclockwise.

b) Decrease the output voltage of the Converter to the desired alarm value by turning counterclockwise the screwdriver adjustment shaft of potentiometer OUTPUT VOLTAGE (R3), located on circuit card VR-A3.

c) Turn the screwdriver adjustment shaft of potentiometer R1 clockwise, slowly, until lamp CONVERTER FAIL illuminates.

d) Return potentiometer OUTPUT VOLTAGE (R3) to its original setting.

### Gain Adjustment

**4.05** The gain adjustment potentiometer GAIN ADJ (R3), located on circuit card DRV-A1, sets the Converter regulation control loop gain. This potentiometer has been factory set as required. Field adjustment is not recommended.

### Low Battery Shutdown Adjustment

**4.06** The Low Battery Shutdown Adjustment potentiometer (R28), located on circuit card DRV-A1, sets the value of input voltage at which the Converter will shutdown. This limit has been factory set at 37 volts DC. Field adjustment is not recommended.

### Current Limit Adjustment

**4.07** The current limit adjustment potentiometer (R30), located on circuit card DRV-A1, sets the value at which the output current limit circuit will prevent further increase of output current. This limit has been factory set at 110% of rated output current. Field adjustment is not recommended.

## 5. OPERATION

### General

**5.01** This DC to DC Converter operates from nominal 48 volts DC to provide filtered and regulated DC to the load. An output wiring option allows the user to select either positive or negative output. Since the Converter operates without moving parts, it requires no periodic maintenance or adjustment.

### Starting and Stopping

**5.02** To start or stop Converter operation, place circuit breaker CB1 in the ON or OFF position, respectively. The circuit breaker is located on the front panel directly below the meters.

### Metering

**5.03** This DC to DC Converter is equipped with an output voltmeter (M1) and ammeter (M2) which indicate output voltage and cur

rent, respectively.

### Local Alarms

**5.04** CONVERTER FAILURE: Lamp CONVERTER FAILURE (LED1) will illuminate during a high voltage shutdown, low voltage alarm, low battery shutdown, or converter output failure.

### Remote Alarms

**5.05** High Voltage Shutdown and Low Battery Shutdown: Terminals 3 to 4 and 5 to 6 provide closed circuits; while positive battery is provided at terminals 1 and 2 of terminal block TB3 during a high voltage shutdown condition. Circuit breaker CB1 must be reset manually by placing it in the ON position to resume operation. For a description of the low battery sensing circuit (shown on the schematic diagram as "low battery shutdown"), refer to Para. 2.03.

**5.06** Low Voltage Alarm: Terminals 3 to 4 and 5 to 6 provide closed circuits; while positive battery is provided at terminals 1 and 2 of terminal block TB3 during a low voltage alarm condition.

### Fuses

**5.07** The following table lists the function, size, and type of each fuse used in this DC to DC Converter. If replacement becomes necessary, use the size and type listed, or equivalent.

| Function | Size (Amps) | Type |
|---|---|---|
| F1 DC OUTPUT | 20 HSB16A, HSB16B | Bussmann BAF |
| | 40 HSB30A | Bussmann ABU |
| | 10 HSB8A, HSB8B, HSB6H | Bussmann BAF |
| | 5 HSB3H | Bussmann BAF |

### Component Boards

**5.08** Any of the following component boards can easily be replaced as individual assemblies in the event of a failure of some component on a component board.

### Component Boards

| | |
|---|---|
| DRV-A1 (4338-365) | Driver Circuit |
| *DRV-A1 (4338-390) | Driver Circuit |
| PA-A2 (4337-325) | Power Amplifier Assembly |
| **PA-A2 (4337-039) | Power Amplifier Assembly |
| VR-A3 (4865-646) | Voltage Regulator Circuit |
| HVS/LVA-A4 (4863-760) | High Voltage Shutdown/Low Voltage Alarm Circuits |

*In Models HSB8A (5625-003), HSB16A (5635-007), HSB30A (5645-002) only

**In Models HSB16B (5653-028 and 5653-030), HSB30A (5645-002), and HSB6H (5664-023) only.

## 6. CIRCUIT DESCRIPTION

### General

**6.01** The appropriate schematic diagram shows the electrical and functional circuits of these "HSB" Series DC to DC Converters.

### Input Filter

**6.02** Choke L1, diodes CR1 and CR2, and capacitors C1-C6 and C14 (or C16) form an input filter which will suppress any transient input voltages to the Converter.

### Power Amplifier PA-A2 (4337-325)

**6.03** A portion of the DC input is applied to the power amplifier assembly where the DC voltage is controlled by transistors Q1 and Q2, and is then applied to transformer T1.

**6.04** Transistors Q1 and Q2 operate in a

switching mode amplifying a quasi square wave signal generated by the driver circuit card DRV-A1, described later. This amplified square wave is then applied to power transformer T1 primary. Resistors R1-R3, R16, capacitors C1-C3, and diodes CR1 and CR2 suppress voltage spikes across the collectors of transistors Q1 and Q2.

**Power Amplifier PA-A2** (4337-039)

**6.05** A portion of the DC input is applied to the power amplifier assembly where the DC voltage is controlled by transistors Q1-Q4, and is then applied to transformer T1.

**6.06** Transistors Q1-Q4 operate in a switching mode amplifying a quasi square wave signal generated by the driver circuit card DRV-A1, described later. This amplified square wave is then applied to the power transformer T1 primary. Resistors R1-R3, R16, capacitors C1-C3, and diodes CR1 and CR2 suppress voltage spikes across the collectors of transistors Q1-Q4.

**Output Circuit**

**6.07** The applied square wave of transformer T1 primary is induced on the power secondary windings of T1, which are connected to a rectifying network. This rectified DC voltage is then applied to the output terminals of the Converter.

**6.08** The positive output is applied through inductor L2 while the negative output is applied through ammeter M2. If positive output is required, series diode CR3 and output fuse F1 will be in the positive line; likewise, if negative output is required, series diode CR3 and output fuse F1 will be in the negative line.

**6.09** Series diode CR3 isolates the DC to DC Converter from any parallel connected Converters, thus preventing disturbance of bus voltage by a failed parallel connected Converter. Shunt diode CR6 (in some models) prevents complete loss of bus voltage in boost mode operation due to a failed Converter.

**Driver Circuit DRV-A1** (4338-365 or 4338-390)

**6.10** The driver circuit produces the quasi square wave which is applied alternately to the power transistors located in the power amplifier circuit described above.

**6.11** Clock A1 generates a 40 KHz pulse which is applied to voltage/pulse width Converter A1 generating a ramp. The slope of the ramp is determined by the current through resistor R12. This current is proportional to the input battery voltage. The width of the pulse generated by the VPW Converter A1 is determined by the slope of the ramp, by transistor Q6, and by the conduction of photo-coupler Q1. Photo-coupler Q1 is controlled by the regulator circuit. Transistor Q6 is controlled by the instantaneous collector current in the power amplifier circuit. Flip-flop A2 generates a 20 KHz square wave from the pulse produced by clock A1. The clock pulse, VPW converter output, and the square wave are combined in NAND gate A3 to form two out-of-phase variable quasi square waves. The two quasi square waves and their complement are buffered by A4. The quasi-square waves are amplified by transistors Q2-Q5 which operate in a constant current mode while their complement is amplified by transistors Q7 and Q8 which operates as a clamp on transformer T1 primary. Diodes CR12-CR14 provide bias for the amplifier transistors and provide voltage for circuits A1-A4 operation. Windings 1, 2 and 3, 4 of transformer T1 provide base drive voltage; while winding 9, 10 of transformer T1 provides power to operate the regulator and alarm circuits.

**6.12** Battery voltage is applied to a voltage divider consisting of resistor R26 and potentiometer R28. When the divider voltage increases sufficiently to overcome the voltage across zener diode CR17, transistor Q10 will conduct. Transistor Q10, conducting, will bias transistor Q9 off, thus allowing capacitor C13 to charge. When capacitor C13 becomes fully charged, the VPW Converter A1 will begin to deliver maximum pulse width, which will result in full output power of the Converter.

**6.13** The output current of the Converter is detected by a current transformer, located in the power amplifier circuit, and converted to a voltage which is applied to diodes CR20-CR23. This rectified voltage is then applied across capacitor C6. When the charge across capacitor C6 exceeds the reference voltage of zener diode CR1 on mini-board (4337-040) which is located on the driver circuit card, transistor Q6 will begin to conduct. The conduction of transistor Q6 will reduce the conduction angle through diode CR18 and lower the clock frequency through diodes CR19 and resistor R19.

**Voltage Regulator Circuit VR-A3** (4865-646)

**6.14** The voltage regulator circuit monitors the output voltage of the Converter. The output of the voltage regulator provides the VPW Converter with the error signal which will control the output voltage.

**6.15** Comparator A1G3 compares the signal developed across resistor R2 and potentiometer R3, which is proportional to the output voltage, to a reference voltage developed across zener diode CR3. The output of comparator A1G3 is applied through diode CR1 to drive a photo-coupler on the driver circuit card. Regulator A1G2 functions as a series regulator for the isolated supply voltage developed across capacitor C8 and supplies voltage to zener diode CR3 and the photo-coupler on DRV-A1. Diodes CR4-CR11 comprise alternate rectifiers for the 20 KHz power from the driver circuit and the output circuit.

**High Voltage Shutdown Low Voltage Alarm HVS/LVA-A4** (4863-760)

**6.16** The HVS/LVA-A4 circuit card monitors the DC output voltage of the Converter. The circuit card contains two circuits: one that will cause the Converter to shutdown due to a high output voltage, and one that will cause an alarm to be extended due to a low output voltage.

**6.17** DC output voltage is applied across resistor R4 and potentometer R2, which is adjusted for a high voltage shutdown level. When the output voltage increases, the reference voltage developed across zener diode CR3 will remain stable, thus this difference between the voltage across potentiometer R2 and zener diode CR3 will be detected by comparator A1G1. Comparator A1G1 will swing positive causing light sensitive transistor Q1 to stop conducting, biasing transistor Q2 off and Q3 on. Conduction of transistor Q3 will cause ground to be applied to the trip coil of circuit breaker CB1, thus causing the Converter to shutdown.

**6.18** DC output voltage is applied across resistor R4 and potentiometer R1, which is adjusted for a low voltage alarm level. When the output voltage decreases, the reference voltage developed across zener diode CR3 will remain stable, thus this difference between the voltage across potentiometer R1 and zener diode CR3 will be detected by comparator A1G2. Comparator A1G2 will swing positive causing light sensitive transistor Q4 to stop conducting, biasing transistors Q5 and Q6 off. Non-conduction of transistor Q6 will cause relay K1 to de-energize. Contacts of relay K1, de-energized, will provide two closed loop circuits and supply ground at two terminals for activation of external alarms, if connected.



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APARTADO POSTAL 77001
MEXICO 10, D.F., MEXICO
TEL: 576-82-77
TLX: 01774308 (1774308 LORME)

# ELECTRICAL PARTS LIST
# LORAIN MODEL HSB8B DC TO DC CONVERTER
# SPEC. NO. 5653-027

This Electrical Parts List is arranged alphabetically by part name. Spare parts are not usually required if adequate standby equipment is available and if the LORAIN EQUIPMENT is installed at an accessible location so that parts can readily be obtained from Lorain Products stock. When ordering parts, please furnish equipment Model No., Spec. No., and Serial No. as given on the equipment nameplate. The quantity of spare parts listed should be sufficient for ten or less assemblies or models for at least 18 months. If a single asterisk (*) appears in the Quantity Recm. Spares column, it indicates the part, assembly, or model is listed more than once, in which case, use the quantity where the item first appears. If two asterisks (**) appear, refer to the sub-list for that assembly or model. If a dash (-) appears, this indicates that spares are not recommended for this part or assembly.

| Ref. Desig. | LPC Part No. | Description | Quantity Recm. Spares |
|---|---|---|---|
| **ASSEMBLIES** | | | |
| A1 | 4338-365 | Driver PW Board | 1 |
| A2 | 4337-325 | Power Amplifier PW Board | 1 |
| A3 | 4865-646 | Voltage/Current Regulator PW Board | 1 |
| A4 | 4863-760 | High Volt Shutdown/Low Volt Alarm PW | 1 |
| LED1 | 4257-022 | LED Circuit Board | 1 |
| **CAPACITORS** | | | |
| C1 | 2731-106 | 10UF 100 Volt, Electrolytic | - |
| C2 | 2713-173 | 1UF 100 Volt DC | 1 |
| C3 | 2731-270 | 2500UF 75 Volt, Electrolytic | - |
| C4 | 2724-140 | 0.01UF 1000 Volt DC | 1 |
| C5 | 2724-140 | 0.01UF 1000 Volt DC | * |
| C6 | 2724-106 | 0.1UF 500 Volt DC | 1 |
| C7 | 2724-146 | 680PF 1000 Volt DC | 1 |
| C8 | 2724-140 | 0.01UF 1000 Volt DC | * |
| C9 | 2724-106 | 0.1UF 500 Volt DC | * |
| C10 | 2731-270 | 2500UF 75 Volt, Electrolytic | - |
| C11 | 2724-146 | 680PF 1000 Volt DC | * |
| C12 | 2737-128 | 2.2UF 75 Volt, Electrolytic | - |
| C13 | 2724-106 | 0.1UF 500 Volt DC | * |
| C14 | 2724-106 | 0.1UF 500 Volt DC | * |

# ELECTRICAL PARTS LIST
# LORAIN MODEL HSB8B DC TO DC CONVERTER
# SPEC. NO. 5653-027

| Ref. Desig. | LPC Part No. | Description | Quantity Recm. Spares |
|---|---|---|---|
| **CIRCUIT BREAKERS** | | | |
| CB1 | 2566-114 | 25 Amp 32 Volt DC | 1 |
| **DIODES** | | | |
| CR1 | 2812-522 | 1N5402, Silicon | 2 |
| CR2 | 2812- | 1N5402, Silicon | * |
| CR3 | 2813-134 | 1N1200RA, Silicon | 1 |
| **FUSES** | | | |
| F1 | 2483-430 | 10 Amp, Cartridge | 1 |
| **INDUCTORS** | | | |
| L1 | 4411-597 | DC Filter | - |
| L2 | 4414-005 | DC Filter | - |
| **METERS** | | | |
| M1 | 2943-425 | 0-75 Voltmeter, DC | - |
| M2 | 2923-443 | 0-15 Ammeter, DC | - |
| **RECTIFIERS** | | | |
| A5 | 2822-055 | 1 PH 30 Amp | 1 |
| **RESISTORS** | | | |
| R1 | 2635-682 | 16.2K Ohm 1 Watt, Fixed | 1 |
| R2 | 2615-335 | 1M Ohm 1/2 Watt, Fixed | 1 |
| R3 | 2635-721 | 121 Ohm 1 Watt, Fixed | 1 |
| R4 | 2651-544 | 1000 Ohm 6.5 Watt, Fixed | 1 |
| R5 | 2651-473 | 10 Ohm 6.5 Watt, Fixed | 1 |
| R6 | 2615-476 | 5.6K Ohm 1 Watt, Fixed | 1 |
| R8 | 2635-534 | 130 Ohm 1 Watt, Fixed | 1 |
| R11 | 2651-544 | 1000 Ohm 6.5 Watt, Fixed | * |

# ELECTRICAL PARTS LIST
# LORAIN MODEL HSB8B DC TO DC CONVERTER
# SPEC. NO. 5653-027

| Ref. Desig. | LPC Part No. | Description | Quantity Recm. Spares |
|---|---|---|---|
| **TRANSFORMERS** | | | |
| T1 | 4481-016 | Power | - |
| T2 | 4422-527 | Current | - |
| **MISCELLANEOUS** | | | |
| | 2488-141 | Fuseholder | 1 |

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MEXICO 10, D F MEXICO
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TLX 01774308 (1774308 LORME)

CIRCUIT NOTES:

101. FUSES SHOWN IN THIS TABLE ARE NOT PART OF EQUIPMENT

| DESIG | FUSE AMP | POTENTIAL | ONE PER |
|---|---|---|---|
| | | | |

BATTERY AND POWER SUPPLIES SYMBOLS

VOLTAGE RANGE

40-60

102. UNLESS OTHERWISE SPECIFIED THE FOLLOWING OPTION IS PROVIDED. Y

| OPTION | REFERENCES | |
|---|---|---|
| | WIRING | CONNECT TB2 JUMPERS |
| POS OUTPUT | _Y_ | 5 TO 9, 6 TO 8, 7 TO 10 |
| NEG OUTPUT | _Z | 5 TO 7, 6 TO 10, 8 TO 9 |

103. OPTIONAL FRAME GROUND FOR PROTECTION AGAINST REVERSE BATTERY POLARITY MAY BE REMOVED AFTER INSTALLATION.

EQUIPMENT NOTES:

201. REFER TO PD-5653-027 FOR EXTERNAL CONNECTIONS, FUSING AND WIRE SIZE.

INFORMATION NOTES:

301. UNLESS OTHERWISE SPECIFIED, RESISTANCE VALUES ARE IN OHMS, CAPACITANCE VALUES ARE MICROFARADS, AND VALUES PRECEDED BY THE SYMBOL + (PLUS), OR — (MINUS) ARE IN VOLTS.

302. CODES WITHIN PARENTHESES, AS (4338-281) REPRESENT LPC PART NUMBERS.

303. SEE WIRING DIAGRAM, T-5653-027 FOR LPC PART NUMBERS OF COMPONENTS.

304. HIGHEST REF DESIG. USED ON THIS DRAWING:

| RES. | XMFR | DIODES | ASSYS | FUSES | CAP |
|---|---|---|---|---|---|
| R11 | T2 | CR3 | A5 | F1 | C14 |
| NOT USED | | | | | |
| R7,9,10 | | | | | |
| | | | | | |
| | | | | | |

REVISIONS

| NO. | CHKD BY / CHG. REQ. NO. | DATE | DESCRIPTION |
|---|---|---|---|
| 1 | | | NEW |
| 2 | 1835633 | 9 23 75 | POLARITY OPTION REVISED. G. Sobotka 9-24-75 |
| 3 | 1835779 | 12 4 75 | T2 AND R8 ADDED G. Sobotka 12-4-75 |
| 4 | 1836092 | 5 17 76 | R11 ADDED G. Sobotka 5-17-76 |
| 5 | 1836438 | 8-16-78 | JJJ NEG.(-) TERM. ADDED TO A5. G. Sobotka 9-6-78 |
| 6 | 1837001 | 4-23-79 | S.M.G. REMOVED R7; A1 WAS 4338-2[illegible] A3 WAS 4865-611; REMOVE WIRE P FROM M2 & A3. G. Sobotka 26 Apr 79 5/9/79 |

181-1149

FUNCTIONAL SCHEMATIC
FOR
DC-DC CONVERTER
MODEL HSB8B

| | |
|---|---|
| DESIGN | N. KAMMILLER ISS. 6 |
| DRAWN BY | J. BARR DATE 6-9-75 |
| CHECKED BY | J. Langlois DATE 6-10-75 |
| CHECKED BY | N. KAMMILLER DATE 9-26-75 |
| APPROVED BY | DATE 9-8-75 |
| RATING | |

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DWG SIZE D

SD-5653-027

SHEET 1 OF 2

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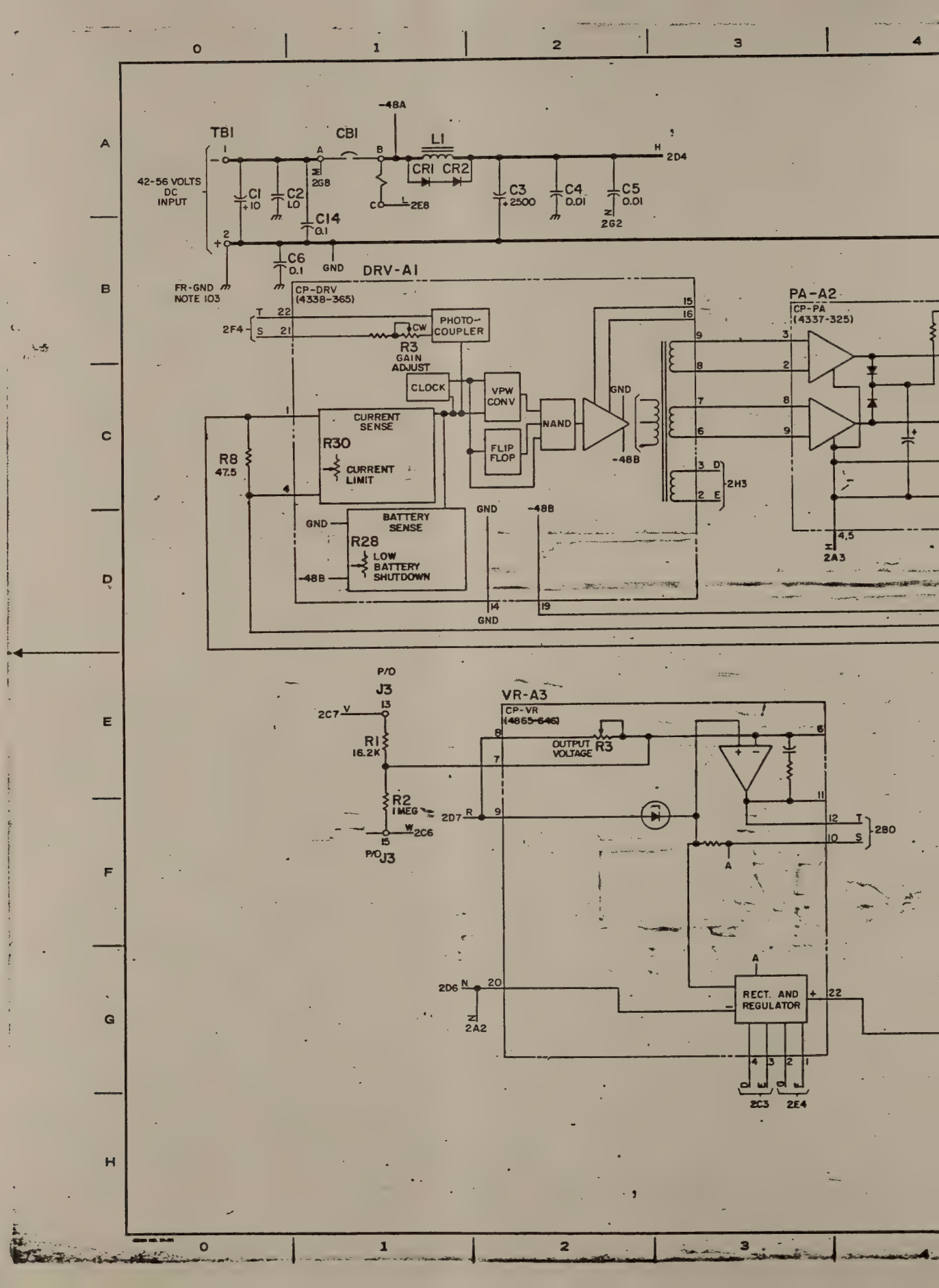
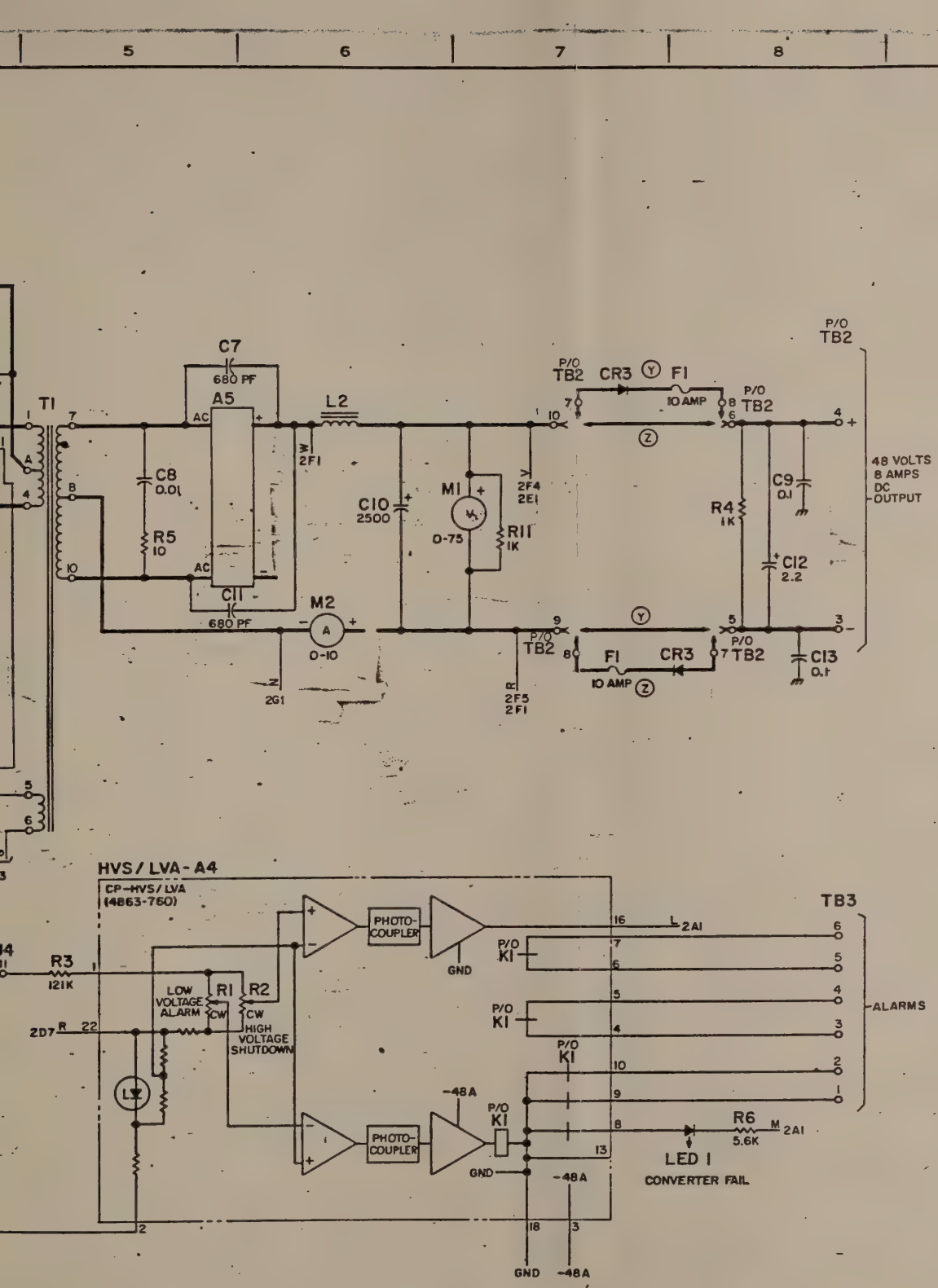

-48A
TB1
CB1
L1
CR1
CR2
42-56 VOLTS DC INPUT
C1 +10
C2 LO
C14 0.1
C6 0.1
GND
C3 +2500
C4 0.01
C5 0.01
2G8
2E8
2G2
2D4
FR-GND NOTE 103
DRV-A1
CP-DRV (4338-365)
2F4
PHOTO-COUPLER
R3 GAIN ADJUST
CW
CLOCK
VPW CONV
FLIP FLOP
NAND
CURRENT SENSE
R30
CURRENT LIMIT
R8 47.5
BATTERY SENSE
R28
LOW BATTERY SHUTDOWN
-48B
GND
PA-A2
CP-PA (4337-325)
2H3
2A3
P/O J3
2C7
R1 16.2K
R2 1MEG
2C6
2D7
VR-A3
CP-VR (4865-646)
OUTPUT VOLTAGE R3
280
2D6
2A2
RECT. AND REGULATOR
2C3
2E4




| DRAWING ISSUE | |
|---|---|
| 1 | 6-9-75 |
| 2 | 6-13-75 |
| 3 | 6-27-75 |
| 4 | 7-2-75 |
| 5 | |
| 6 | 7-29-75 |

ISSUE 6

MODEL HSB8B

SD-5653-027

LORAIN PRODUCTS CORPORATION

DWG SIZE D

SHEET 2

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# CPS-PA

(POWER AMPLIFIER)

COMPONENT LIST

CAPACITORS

| DESIG | CODE |
|---|---|
| (2) C1,C3 | (2724-181) 0.022 UF, 1000V DC |
| C2 | (2731-607) 20 UF, 150V DC, ELECT. |

DIODES

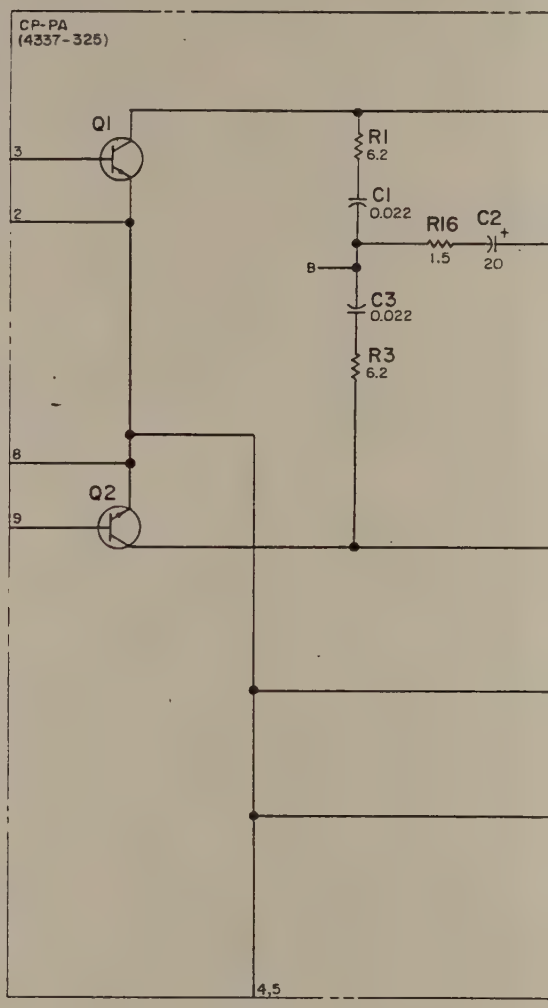
| DESIG | CODE |
|---|---|
| (2) CR1,CR2 | (2812-220) |

RESISTORS

| DESIG | CODE |
|---|---|
| (2) R1,R3 | (2651-466) 6.2 OHM, 6 1/2 W, 5% |
| R2 | (2652-488) 1K, 1W, 5% |
| R16 | (2651-105) 1.5 OHM, 3 W, 5% |

TRANSISTORS

| DESIG | CODE |
|---|---|
| (2) Q1,2 | (2842-170) |




INPUT/OUTPUT INFORMATION

CIRCUIT DESCRIPTION

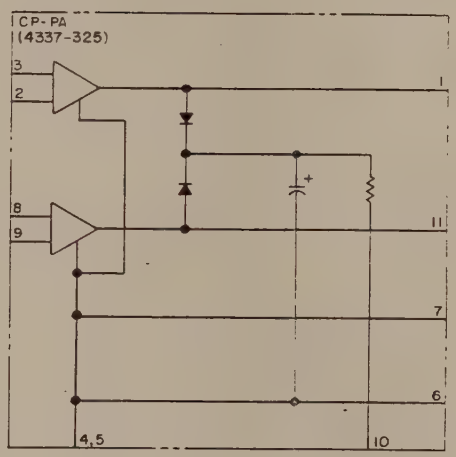
Q1 - Q2 OPERATE IN THE SWITCHING MODE AMPLIFYING A QUASI SQUARE WAVE SIGNAL APPEARING AT 2-3, 8-9. R1-R3,C1-C3,CR1,CR2 LIMIT VOLTAGE PEAKS ON Q1-Q2 COLLECTORS.

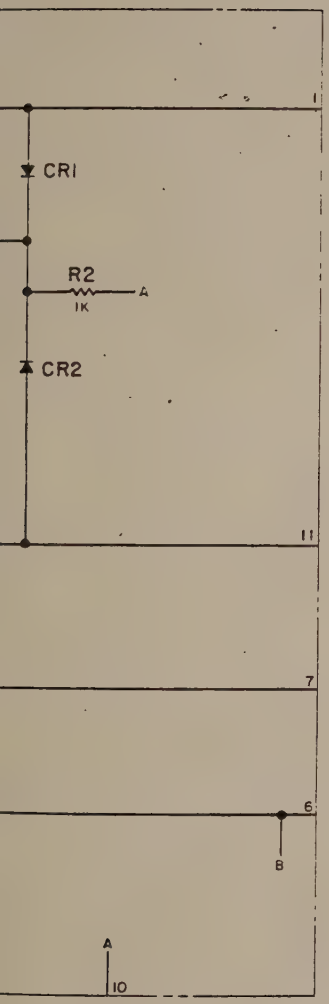
| REVISIONS | | | |
|---|---|---|---|
| ISS NO. | CHG'D BY / CHG SLIP NO. | DATE | DESCRIPTION |
| 1 | M | | NEW |
| 2 | M 1835708 L.D. | 10 23 75 | R16 ADDED |
| 3 | 1835779 M.R.J. | 12 2 75 | R4 – R9 REMOVED |

MANUFACTURING REFERENCES

| CATEGORY | NUMBER |
|---|---|
| ASSEMBLY DRAWING | 4337-325 |
| CONNECTOR ON FRAME | |

SYMBOL




NOTES:

1. UNLESS OTHERWISE SPECIFIED, RESISTANCE VALUES ARE IN OHMS AND CAPACITANCE VALUES ARE IN MICROFARADS; VALUES PRECEDED BY THE SYMBOL + (PLUS), OR – (MINUS), ARE IN VOLTS.
2. CODES WITHIN PARENTHESES, AS (2724-181), REPRESENT LPC PART NUMBERS.

1811081

DESIGN: N.KAMMILLER ISS

DRAWN BY J. REESE DATE 6-18-75

CHECKED BY DATE 6-18-75

CHECKED BY N.KAMMILLER DATE 8-26-75

APPROVED BY DATE 9.8.75

RATING STANDARD

# POWER AMPLIFIER ASSEMBLY

SD-4337-325

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DWG SIZE D

SHEET 1 OF 1



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## COMPONENT LIST

### CAPACITORS

| DESIG | CODE |
|---|---|
| (2) C1,4 | (2724-148) 3300PF, 1000V DC |
| C2 | (2731-129) 50UF, 25V DC, ELECT. |
| C3 | (2724-146) 680PF, 1000V DC |
| (2) C5,12 | (2713-118) 0.01UF, 100V DC |
| C6 | (2737-103) 0.1UF, 35V DC, TANTALUM |
| (2) C7,8 | (2713-205) 0.0022UF, 200V DC |
| (2) C9,10 | (2724-090) 0.1UF, 100V DC |
| C11 | (2731-115) 30UF, 60V DC, ELECT |
| C13 | (2731-125) 47UF, 50V DC, ELECT. |
| C14 | (2724-140) 0.01UF, CERAMIC |
| C15 | (2737-141) 47UF, 20V, TANTALUM |

### DIODE

| DESIG | CODE |
|---|---|
| (11) CR1,2,3,4,5,6,7,8, 15,18,19 | (2811-101) |
| (6) CR9,10,20,21,22,23 | (2812-220) |
| (3) CR12,13,14 | (2835-510) |
| CR16 | (2812-201) |
| CR17 | (2835-411) |
| CR24 | (2834-525) |

### INTEGRATED CIRCUITS

| DESIG | CODE |
|---|---|
| A1 | (2871-004) DUAL TIMER |
| A2 | (2876-101) DUAL FLIP-FLOP |
| A3 | (2876-302) TRIPLE NAND |
| A4 | (2876-401) QUAD BUFFER |
| A5 | (4337-040) CURRENT LIMIT ASSY |

### RESISTORS

| DESIG | CODE |
|---|---|
| R1 | (2662-408) 5.1 OHM, 2W, 5% |
| R2 | (2615-257) 560 OHM, 1/2W |
| R3 | (2675-117) 5K, 1/2W |
| R4 | (2651-305) 3 OHM, -3W |
| R5 | (2635-678) 12.7K, 1W, 1% |
| (4) R6,11,18,27 | (2615-255) 470 OHM, 1/2W |
| (2) R7,17 | (2651-339) 1.5K, 3W, 5% |
| (3) R8,16,22 | (2615-271) 2.2K, 1/2W |
| (2) R9,14 | (2615-291) 15K, 1/2W |
| (2) R10,13 | (2615-263) 1K, 1/2W |
| R12 | (2635-717) 100K, 1W, 1% |
| R15 | (2635-636) 1.58K, 1W, 1% |
| R19 | (2634-623) 3.32K, 1/4W, 1% |
| R20 | (2651-550) 1.5K, 6-1/2W, 5% |
| R21 | (2634-632) 4.75K, 1/4W, 1% |
| R23 | (2615-255) 2.7 OHM, 1/2W |
| R24 | (2615-303) 47K, 1/2W |
| R25 | (2615-295) 22K, 1/2W |
| R26 | (2635-647) 2.94K, 1W, 1% |
| R28 | (2675-113) 1K, 1/2W |
| R29 | (2634-648) 10K, 1/4W, 1% |
| R30 | (2675-114) 2K, 1/2W |
| R31 | (2634-567) 221 OHM, 1/4W, 1% |
| R32 | (2634-682) 51.1K, 1/4W, 1% |

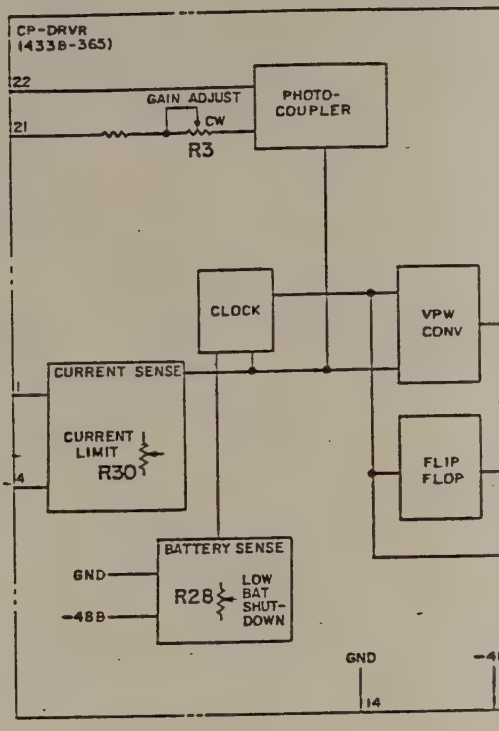
### TRANSFORMERS

| DESIG | CODE |
|---|---|
| T1 | (4481-015) |

### TRANSISTORS

| DESIG | CODE |
|---|---|
| Q1 | (2857-101) PHOTO COUPLER |
| (2) Q2,5 | (2844-010) PNP |
| (5) Q3,4,6,7,8 | (2841-155) NPN |
| (2) Q9,10 | (2841-100) NPN |

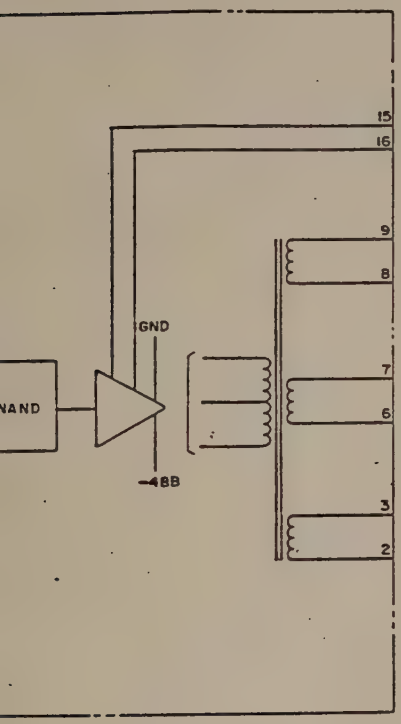
SYMBOL




### CIRCUIT DESCRIPTION

A1 CLOCK GENERATES 40 KHZ PULSE WHICH STARTS RAMP GENERATED IN A1 VOLTAGE/PULSE WIDTH CONVERTER. RAMP SLOPE OF VPW CONV. IS DETERMINED BY CURRENT THRU R12 PROPORTIONAL TO BATTERY VOLTAGE. PULSE WIDTH OUT OF VPW CONV. IS DETERMINED BY RAMP SLOPE AND CONDUCTION OF Q1, WHICH IS CONTROLLED BY REGULATOR CKT AND Q6, WHICH IS CONTROLLED BY INSTANTANEOUS COLLECTOR CURRENT IN POWER AMPLIFIER. A2 FLIP FLOP GENERATES 20 KHZ SQUARE WAVE FROM CLOCK PULSE. CLOCK PULSE, VPW CONV. OUTPUT AND SQUARE WAVE ARE COMBINED IN A3 NAND GATE TO FORM TWO OUT OF PHASE WIDTH VARIABLE QUASI SQUARE WAVES AND THEIR COMPLEMENT WHICH ARE BUFFERED BY A4. THE QUASI SQUARE WAVES ARE AMPLIFIED BY Q2, Q3, Q4, Q5 OPERATING IN THE CONSTANT CURRENT MODE. THE COMPLEMENT IS AMPLIFIED BY Q7, Q8 OPERATING AS A CLAMP ON T1 TRANSFORMER PRIMARY. CR12-CR14 DEVELOP BIAS FOR AMPLIFIER TRANSISTORS AND SUPPLY VOLTAGE FOR A1-A4 CIRCUITS. WINDINGS 1,2 AND 3,4 PRODUCE BASE DRIVE VOLTAGE. WINDING 9,10 DEVELOPES POWER TO OPERATE REGULATOR AND ALARM CIRCUITS.

R26,R28 FORM A VOLTAGE
WITH REFERENCE CR17 TO
UNTIL BATTERY IS SUFFI
ALLOWING VPW CONV. TO
CURRENT TRANSFORMER LO
C6 VOLTAGE EXCEEDS REF
CR18 AND CLOCK FREQUEN




MANUFACTURING REFERENCES

| CATEGORY | NUMBER |
|---|---|
| ASSEMBLY DRAWING | 4338-365 |
| P.W. BOARD | 3157-193 |
| CONNECTOR ON FRAME | 2475-772 |

REVISIONS

| | | | |
|---|---|---|---|
| | | | |

1 NEW. REF. 4338-281

2 1836873 6-21-79 S.M.G.
CR24 WAS 2834-524

3 1837320 2-4-81 J.R.
C13, 15 WERE 2737-141

4 1837357 3-23-81 D.A.C.
C9 & 10 WERE 2724-106

5 1837527 5-18-81 J.R.
C15 WAS 2731-125

NOTES:

1. UNLESS OTHERWISE SPECIFIED, RESISTANCE VALUES ARE IN OHMS AND CAPACITANCE VALUES ARE IN MICROFARADS; VALUES PRECEDED BY THE SYMBOL + (PLUS), OR — (MINUS), ARE IN VOLTS.
2. CODES WITHIN PARENTHESES, AS (2662-408) REPRESENT LPC PART NUMBERS.

DER ACROSS BATTERY THE OUTPUT OF WHICH IS COMPARED
OL C10 AND Q9. Q9 MAINTAINS C13 AT A LOW VOLTAGE
Y HIGH TO ALLOW STARTING AT WHICH TIME C13 CHARGES
SE PULSE WIDTH. CR20-CR23 RECTIFY OUTPUT OF EXTERNAL
IN POWER AMPLIFIER CIRCUIT AND PEAK CHARGE C6. WHEN
CR1-A5. Q6 CONDUCTS REDUCING CONDUCTION ANGLE THRU
U CR19 AND R19.

1837001

DESIGN G. SCHMITZ ISS. 5
DRAWN BY J J J DATE 3-13-79
CHECKED BY DATE
CHECKED BY G. Schmitz DATE 3-13-79
APPROVED BY DATE
RATING STANDARD

# DRIVER

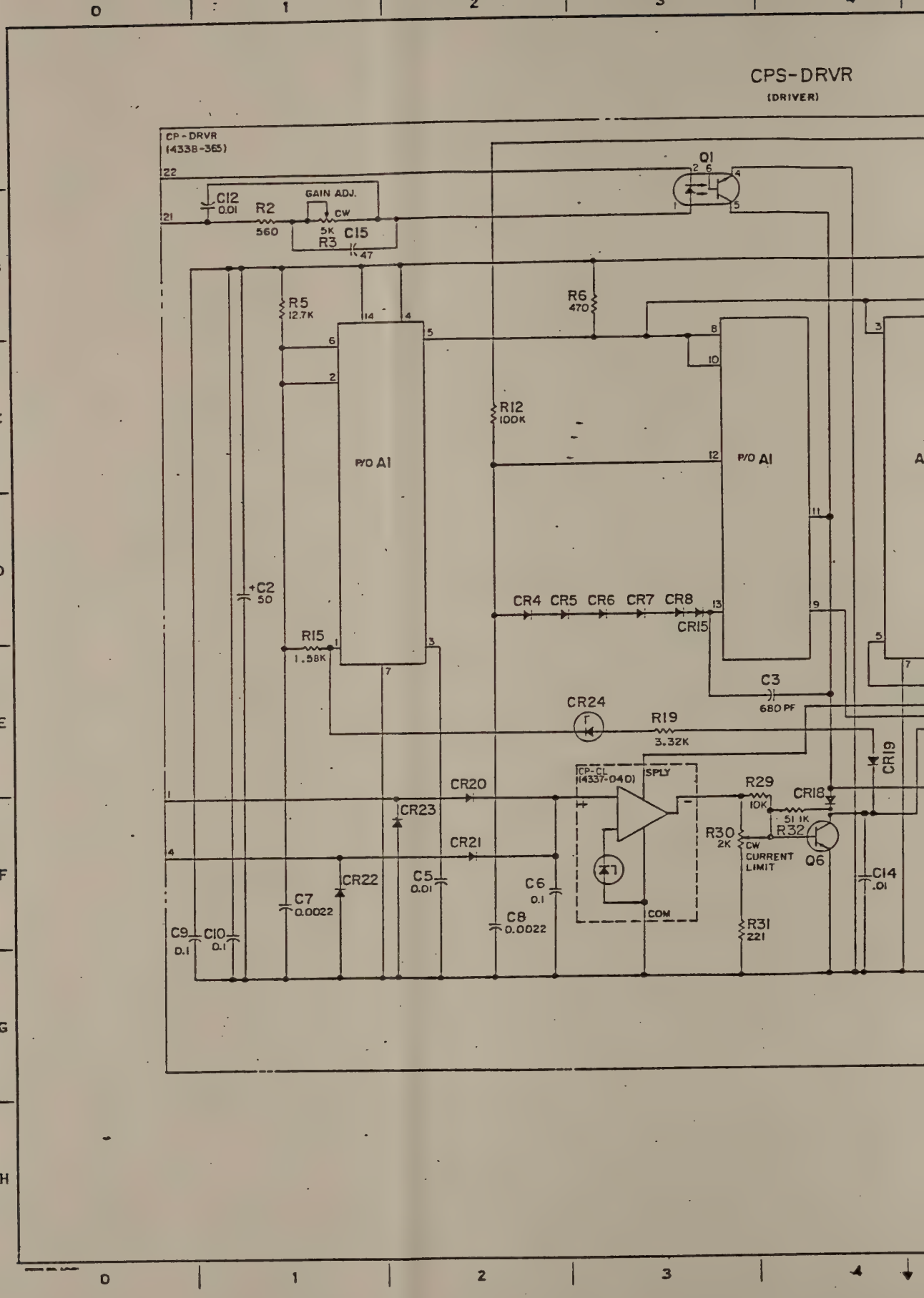
SD-4338-365

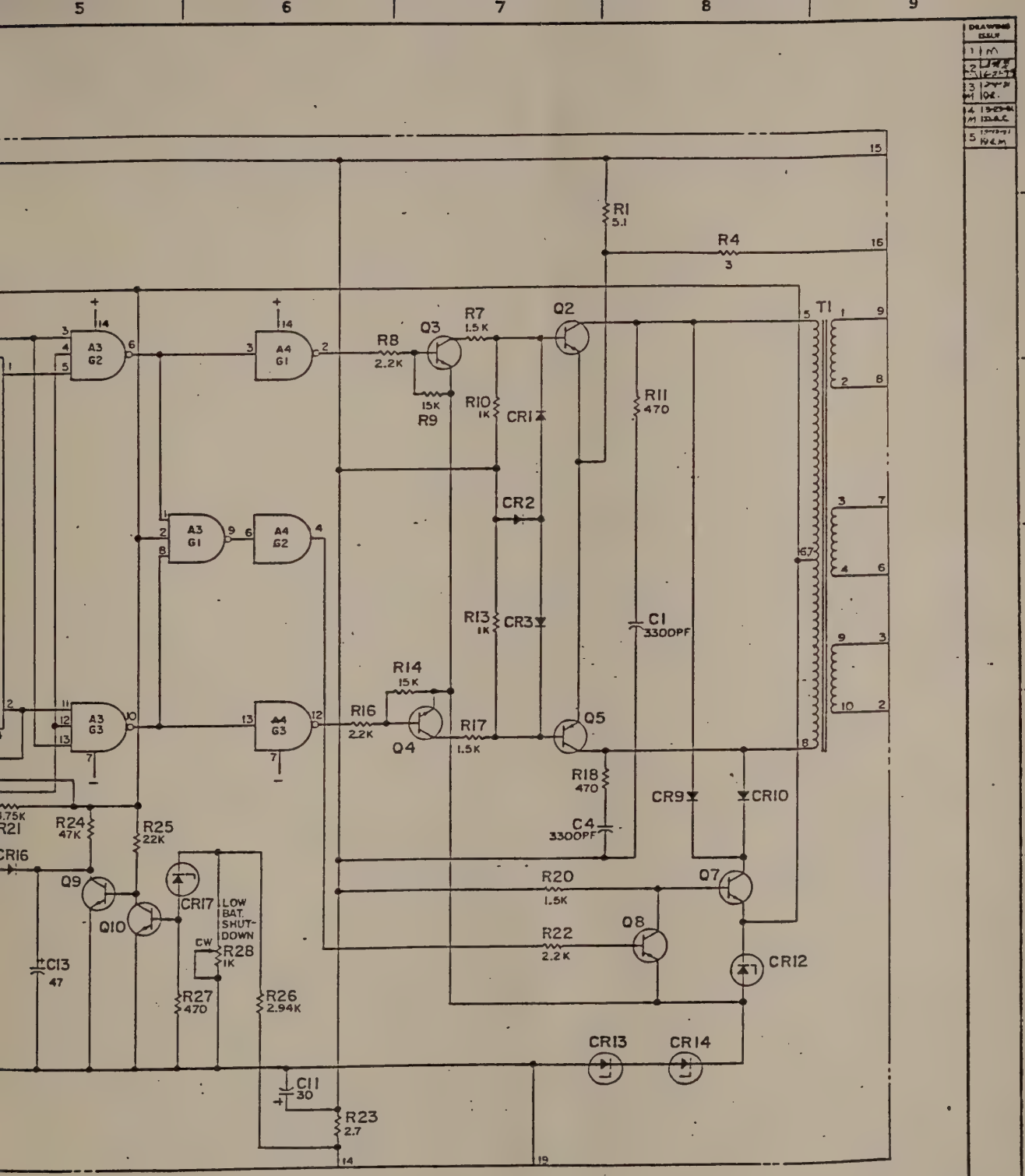
LORAIN PRODUCTS CORPORATION
LORAIN, OHIO

DWG SIZE D

SHEET 1 OF 2

PRINTED IN U.S.A.


CPS-DRVR
(DRIVER)
CP-DRVR
(4338-365)
Q1
C12
0.01
R2
560
GAIN ADJ.
5K
CW
R3
C15
47
R5
12.7K
R6
470
R12
100K
P/O A1
P/O A1
+C2
50
CR4 CR5 CR6 CR7 CR8
CR15
R15
1.58K
C3
680 PF
CR24
R19
3.32K
CR19
(CP-CL
(4337-040)
SPLY
COM
CR20
CR23
CR21
CR22
R29
10K
CR18
51.1K
R30
2K
R32
CW
CURRENT
LIMIT
Q6
C14
.01
C5
0.01
C6
0.1
C7
0.0022
C8
0.0022
C9
0.1
C10
0.1
R31
221




| | |
|---|---|
| DRIVER | SD-4338-365 |
| LORAIN PRODUCTS CORPORATION | SIZE D |
| | SHEET 2 |
| | SCALE 5 |

# CPS-VR

(VOLTAGE REGULATOR)

COMPONENT LIST

CAPACITORS

| DESIG | CODE |
|---|---|
| C1 | (2724-090) 0.1UF, 100V DC |
| C2 | (2713-132) 0.1UF, 1000V DC |
| C3 | (2724-140) 0.01UF, 1000V DC |
| C4 | (2731-105) 10UF, 50V DC, ELECT |
| C8 | (2731-225) 1100UF, 40V DC, ELECT. |
| C9 | (2724-125) 220PF, 500V DC |

DIODES

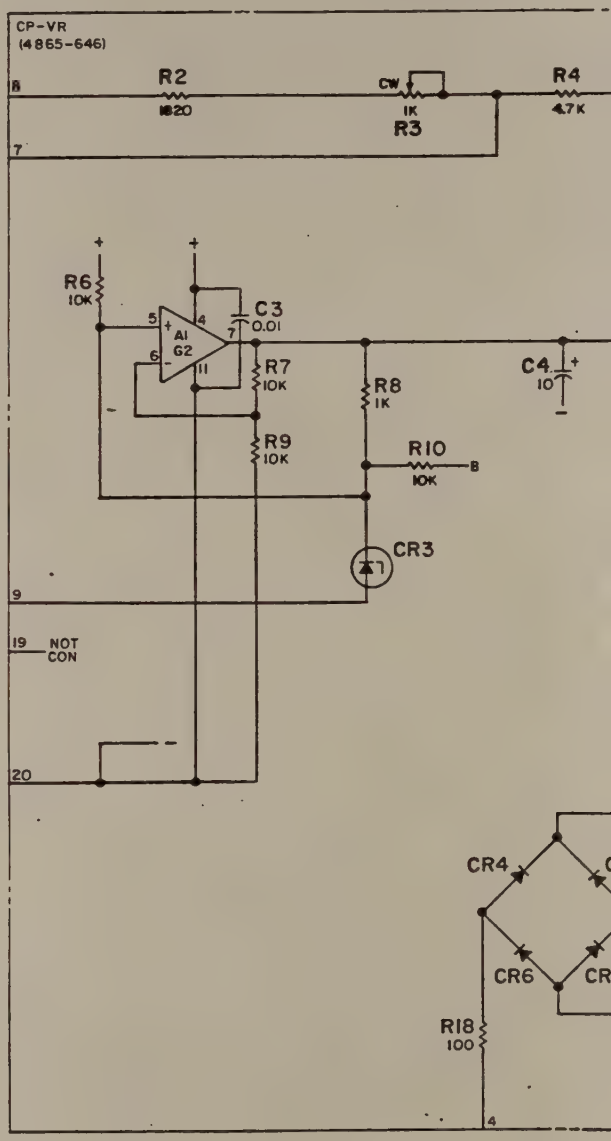
| DESIG | CODE |
|---|---|
| (5) CR1,4,5,6,7 | (2811-101) |
| CR3 | (2835-325) 6.2V, 0.4W, ZENER |
| (4) CR8,9,10,11 | (2812-220) |

INTEGRATED CIRCUITS

| DESIG | CODE |
|---|---|
| A1 | (2871-115) |

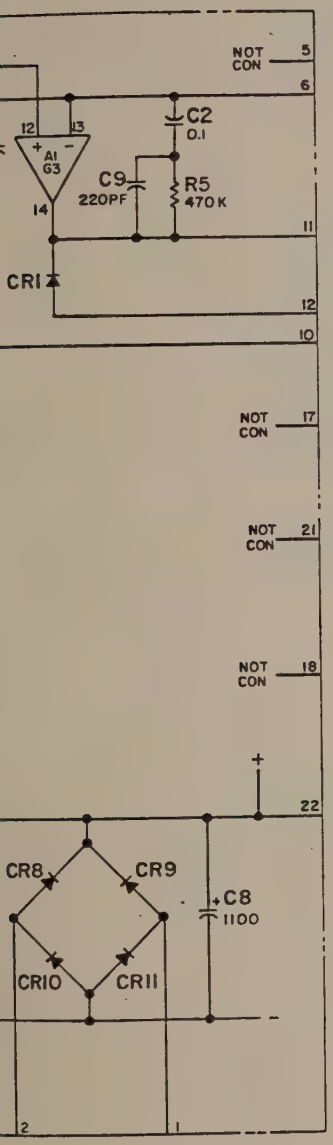
RESISTORS

| DESIG | CODE |
|---|---|
| R2 | (2635-637) 1820 OHM 1W 1% |
| R3 | (2675-113) 1K, 1/2W, POT |
| R4 | (2615-279) 4.7K, 1/2W |
| R5 | (2615-327) 470K, 1/2W |
| (3) R6,7,9 | (2615-287) 10K, 1/2W |
| R8 | (2635-624) 1K, 1W, 1% |
| R10 | (2635-673) 10K, 1W, 1% |
| R18 | (2615-239) 100 OHM 1/2W |




CIRCUIT DESCRIPTION

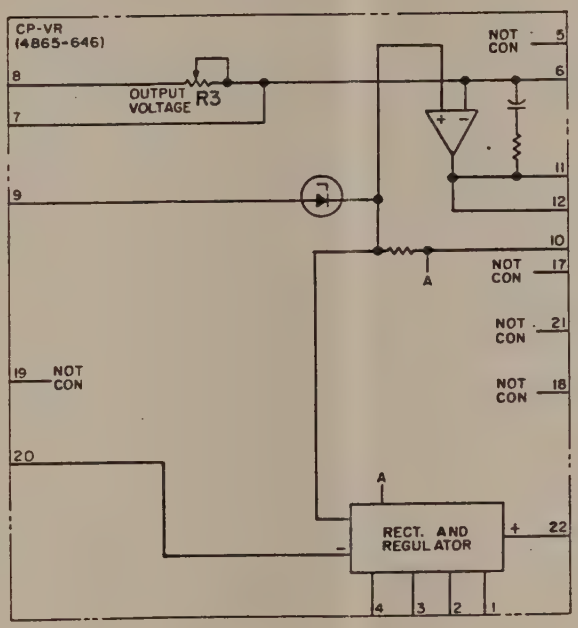
A1G1 COMPARES SIGNAL DEVELOPED ACROSS R2, R3 PROPORTIONAL TO OUTPUT VOLTAGE WITH REFERENCE DEVELOPED ACROSS CR3. COMPARATOR OUTPUT CONNECTED BY DIODE CR1. DIODE OUTPUT DRIVES OFF BOARD PHOTO ISOLATOR. A1G3 FUNCTIONS AS A SERIES REGULATOR FOR ISOLATED SUPPLY VOLTAGE DEVELOPED ACROSS C5 AND SUPPLIES PHOTO ISOLATOR AND CR3 REFERENCE. CR4-CR11 COMPRISES ALTERNATE RECTIFIERS FOR 20K HZ POWER FROM DRIVER AND OUTPUT CIRCUITS.




MANUFACTURING REFERENCES

| CATEGORY | NUMBER |
|---|---|
| ASSEMBLY DRAWING | 4865-646 |
| P.W. BOARD | 3158-510 |
| CONNECTOR ON FRAME | 2475-776 |

SYMBOL




NOTES:

1. UNLESS OTHERWISE SPECIFIED, RESISTANCE VALUES ARE IN OHMS, AND CAPACITANCE VALUES ARE IN MICROFARADS; VALUES PRECEDED BY THE SYMBOL + (PLUS), OR - (MINUS), ARE IN VOLTS.
2. CODES WITHIN PARENTHESES, AS (2713-142), REPRESENT LPC PART NUMBERS.

REVISIONS

| NO. | CHG. BY | DATE | DESCRIPTION |
|---|---|---|---|
| 1 | NEW | | REF. 4865-646 |
| 2 | M | 3-18-81 | CI WAS 2724-106 |

1837001

VOLTAGE REGULATOR

| | |
|---|---|
| DESIGN | G. SCHMITZ |
| DRAWN BY | JJJ |
| DATE | 3-12-79 |
| CHECKED BY | |
| DATE | |
| CHECKED BY | G. Schmitz |
| DATE | 3-13-79 |
| APPROVED BY | (Engineering Standards) |
| DATE | 3/22/79 |
| RATING | |

SD-4865-646

LORAIN PRODUCTS CORPORATION
LORAIN, OHIO

DWG SIZE D

SHEET 1 OF 1

# CPS-HVS/LVA

(HIGH VOLTAGE SHUTDOWN - LOW VOL

## COMPONENT LIST

### CAPACITOR

| DESIG | CODE |
|---|---|
| C1 | (2713-132) 0.1 UF, 100 VDC |
| C2 | (2731-103) 10 UF, 100 VDC, ELECT. |
| C3 | (2724-140) 0.01UF, 1000 VDC |

### DIODES

| DESIG | CODE |
|---|---|
| (2) CR1,2 | (2812-223) |
| CR3 | (2835-325) 6.2V, 400MW, ZENER |

### INTEGRATED CIRCUITS

| DESIG | CODE |
|---|---|
| A1 | (2871-115) QUAD OP-AMP |

### RELAYS

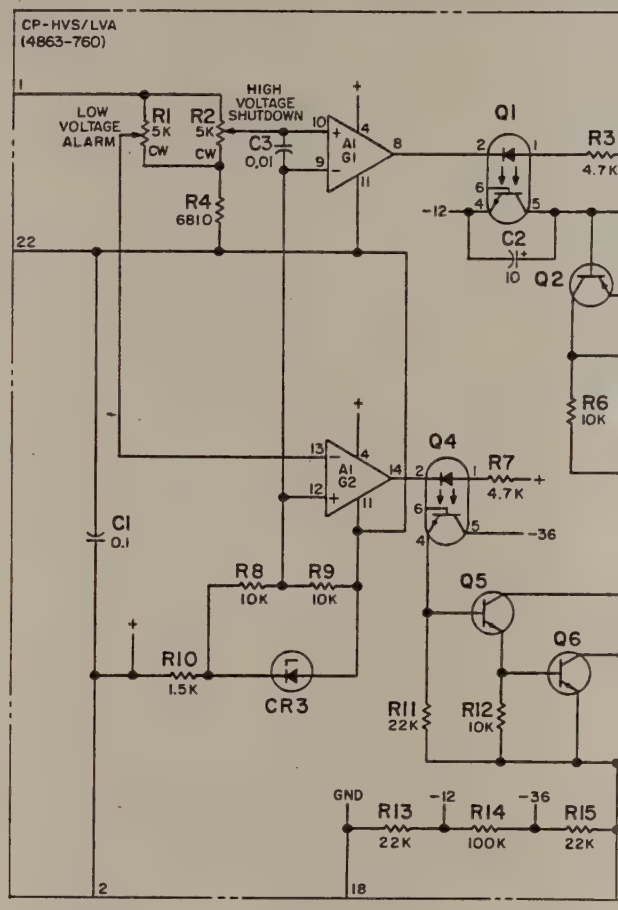
| DESIG | CODE |
|---|---|
| K1 | (2543-443) 1940 OHM, 62V, COIL |

### RESISTORS

| DESIG | CODE |
|---|---|
| (2) R1,2 | (2675-117) 5K, 1/2W, POT. |
| (2) R3,7 | (2615-279) 4.7K, 1/2W |
| R4 | (2635-665) 6810 OHM, 1 W, 1% |
| (2) R5,12 | (2615-287) 10K, 1/2W |
| R6 | (2615-487) 10K, 1W |
| (2) R8,9 | (2635-673) 10K, 1W, 1% |
| R10 | (2615-267) 1.5K, 1/2W, |
| (3) R11,13,15 | (2615-295) 22K, 1/2W |
| R14 | (2615-311) 100K, 1/2W |

### TRANSISTORS

| DESIG | CODE |
|---|---|
| (2) Q1,4 | (2857-101) PHOTO-COUPLER |
| Q2 | (2843-151) PNP |
| Q3 | (2843-041) PNP |
| (2) Q5,6 | (2841-102) NPN |

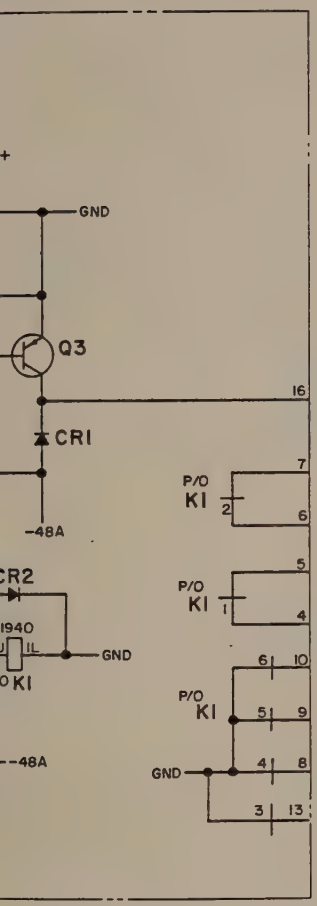



## INPUT/OUTPUT INFORMATION

## CIRCUIT DESCRIPTION

A PORTION OF OUTPUT VOLTAGE IS DEVELOPED ACROSS R1, R2, R4. IT IS COMPARED WITH REFERENCE DEVELOPED ACROSS CR3 AT A1, G1 AND G2. A1, G1 OUTPUT IS ISOLATED BY Q1 AND AMPLIFIED BY Q2, Q3 TO ENERGIZE COIL OF VOLTAGE TRIP INPUT CIRCUIT BREAKER ON OVERVOLTAGE CONDITION. A1, G2 OUTPUT IS ISOLATED BY Q4 AND AMPLIFIED BY Q5, Q6 TO ENERGIZE K1 LOW VOLTAGE ALARM RELAY.

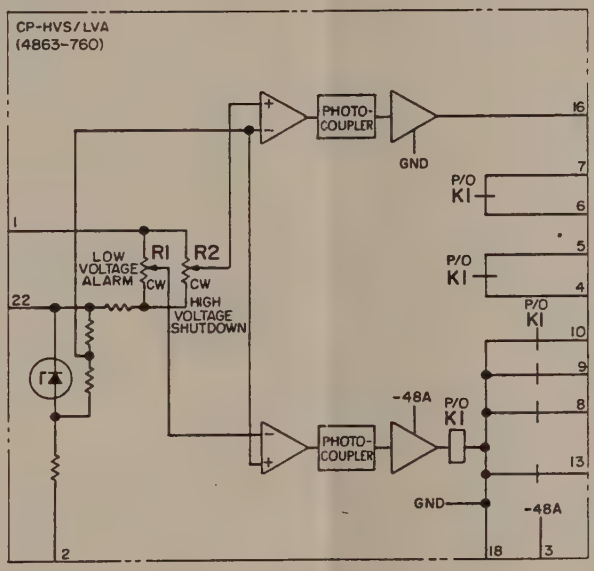
ALARM)




MANUFACTURING REFERENCES

| CATEGORY | NUMBER |
|---|---|
| ASSEMBLY DRAWING | 4863-760 |
| CONNECTOR ON FRAME | 2475-772 |

SYMBOL




NOTES:

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2. CODES WITHIN PARENTHESES, AS (2713-132), REPRESENT LPC PART NUMBERS.

REVISIONS

| NO. | CHNG. ST. CHG. ELEV. NO. | DATE | DESCRIPTION |
|---|---|---|---|
| 1 M | | | NEW |
| 2 M | 1835633 23 75 | 9 | CONTACT SET ADDED. G. SOBOTKA 11-26-75 |
| 3 M | 1835779 | 12 2 75 | "A" DESIGNATION ADDED TO BATTERY SYMBOL G. SOBOTKA 12-3-75 |
| 4 M | 1835984 | 3 15 76 | C3 ADDED. CONNECTOR WAS 2475-776 G. SOBOTKA 3-15-76 |

| | | | |
|---|---|---|---|
| 181-1152 | DESIGN N. KAMMILLER | ISS. 4 | |
| HIGH VOLTAGE SHUTDOWN-LOW VOLTAGE ALARM | DRAWN BY J. BOAR | DATE 4-21-75 | |
| | CHECKED BY V. SPANGLER | DATE 4-21-75 | |
| | CHECKED BY N. KAMMILLER | DATE 4-26-75 | |
| | APPROVED BY [illegible] | DATE 4-8-75 | |
| | RATING | | |
| | SD-4863-760 | | |
| LORAIN PRODUCTS CORPORATION LORAIN, OHIO LORAIN PRODUCTS (CANADA) LTD., ST. THOMAS, ONTARIO | DWG SIZE D | SHEET 1 OF 1 | |

PRINTED IN U.S.A.

| SD-DRAWING ISSUES AND T-DRAWING ISSUES AS FOLLOWS: | | |

MANUFACTURING NOTES:

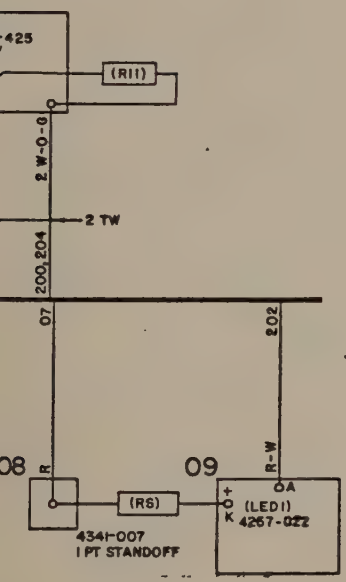
1. ALL WIRES TO BE 20 GA SOLID UNLESS OTHERWISE SPECIFIED.
2. BI- TERMINAL NEAREST MOUNTING SURFACE.
3. 2 TW- TWO WIRES SHALL BE TWISTED TOGETHER.
4. D- INDICATES LEAD IS A JUMPER.
5. PT- LEADS WHICH ARE PART OF COMPONENTS OR SUBASSEMBLIES.
6. UNLESS OTHERWISE SPECIFIED, RESISTANCE VALUES ARE IN OHMS, CAPACITANCE VALUES ARE IN MICROFARADS.
7. SPLICE CRI AND CR2 TOGETHER WITH LPC PT. NO. 2467-352, PARALLEL SPLICE SLEEVE WITH LPC PT. NO. 1675-372 SLEEVING.
8. DIODE CR3 TO BE MOUNTED WITH DIODE INSULATING HARDWARE.
9. UNDER LI, L2 AND TI USE (1 EACH) NO. 8 GND WASHER, LPC PT. NO. 2156-405
10. SLEEVE ALL PT COMPONENTS WITH LPC PT. NO. 1675-356 SLEEVING.
11. WIRES SHALL NOT BE CONNECTED UNTIL SHOP TESTS ARE COMPLETED.
12. LUG TOGETHER WITH LPC PT. NO. 2653-664 LUG.
13. WIRE TO BE RUN THROUGH T2 AS SHOWN IN DETAIL "B". SECURE T2 TO WIRES WITH TY RAP.
14. REMOVE LUGS FROM T2 FOR SOLDERING TO J1.

ENGINEERING NOTES:

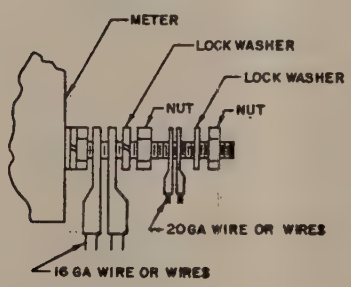
51. OUTPUT POLARITY ADJUSTMENT

| TB2 TERMINAL STRIP | | |
|---|---|---|
| WIRE | POSITIVE OUTPUT | NEGATIVE OUTPUT |
| JUMPERS | 5-9, 6-8, 7-10 | 5-7, 8-10, 8-9 |

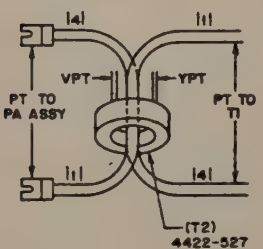
UNLESS OTHERWISE SPECIFIED THE OUTPUT WILL BE CONNECTED FOR POSITIVE OUTPUT.




DETAIL "A"




DETAIL "B"




| REVISIONS | | | | |
|---|---|---|---|---|
| NO. | ORIG. OF CHG. OR ECN | DATE | DESCRIPTION | |
| 2 | 1835633 | 9 30 75 | REDRAWN; POLARITY OPTION REVISED, METERS CHANGED. G. Sobotka 10-1-75 | A |
| 3 | 1835779 | | T2 AND R8 ADDED, NOTES 12 AND 13 ADDED, DETAIL "B" ADDED. G. Sobotka 12-3-75 | |
| 4 | 1835984 | 4 14 76 | J1, J3, J4 WERE L.D. G. Sobotka 4-15-76 | B |
| 5 | 1836092 | 5 17 76 | R11 ADDED G. Sobotka 6-17-76 | |
| | POL KEY WAS 2478-527 ISS 6 | 1836326 | S.K. 10-18-76 | C |
| 7 | 1836438 | 8-16-78 | JJJ A5 WAS 2821-813 G. Sobotka 9-6-78 P. Paradiso 9/7/78 | |
| 8 | 183-7001 | 4-23-79 | S.M.G. REMOVED W-O-G FROM LOC 00, SH.1 TO LOC 04, SH.2; REMOVED R7 FROM LOC 04, SH.2. G. Sobotka 5-4-79 P. Paradiso 5/9/79 | |
| 9 | 1837216 | 6-24-80 | T.I. NOTE 7 CHANGED; PIGTAIL COMPONENT INFO CHANGED. E. Cano 6-30-80 N. Kammiller 6-30-80 | D |

| MATION | |
|---|---|
| | LOC |
| | 03 |
| | 03 |
| | 03 |
| | 04,01 |
| | 08,09 |

| | | | |
|---|---|---|---|
| | DESIGN R. LANGWORTHY | | |
| | DRAWN BY | DATE | |
| WIRING DIAGRAM FOR MODEL HSB8B | CHECKED BY G. SOBOTKA | DATE 8-26-75 | |
| | CHECKED BY N. KAMMILLER | DATE 8-26-75 | |
| | APPROVED BY J. MITCHELL | DATE 9-8-75 | |
| | RATING STANDARD | | |
| | T-5653-027 | | |
| LORAIN PRODUCTS CORPORATION LORAIN, OHIO | DWG SIZE D | SHEET 1 OF 2 | |

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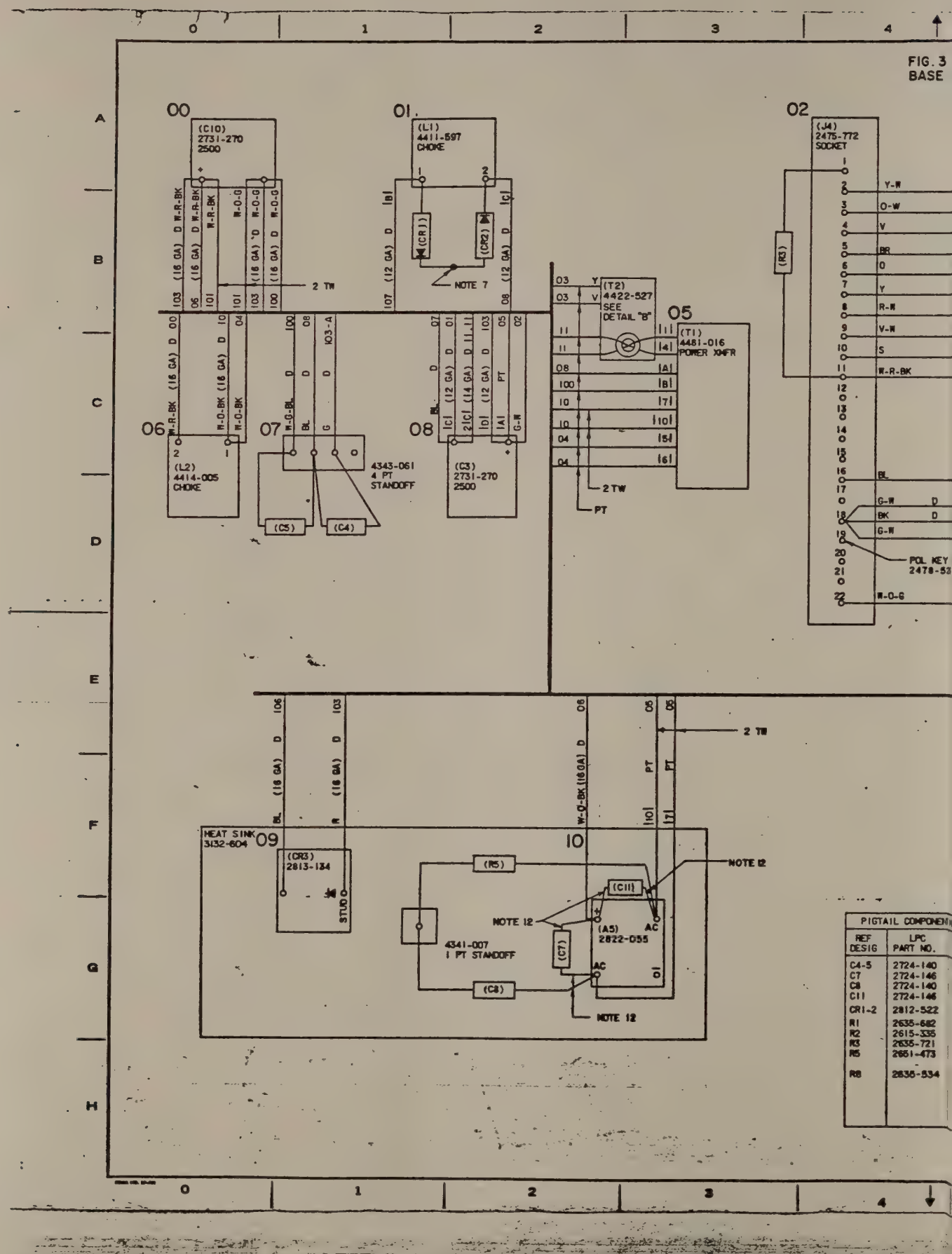
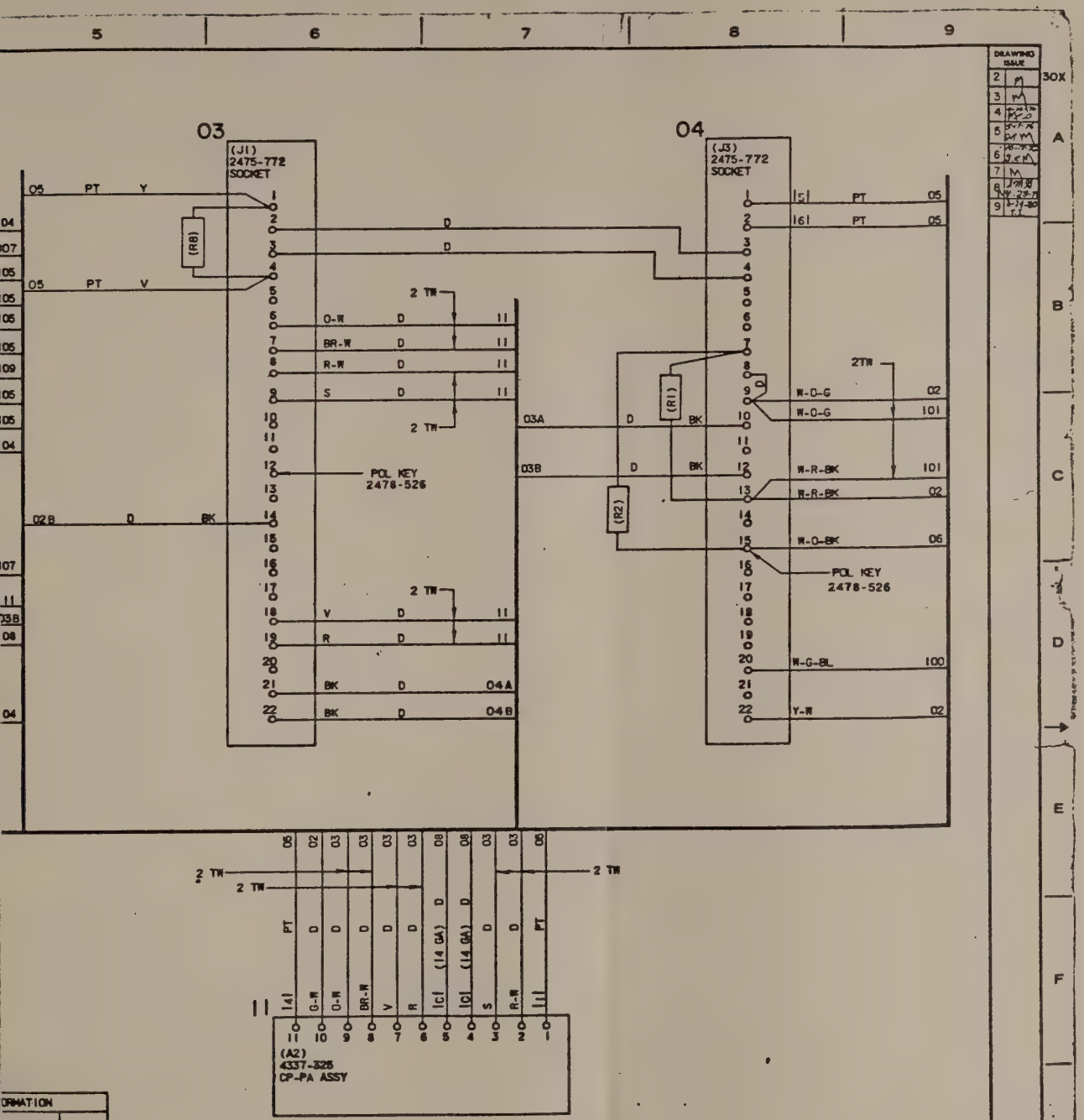
FIG. 3
BASE




| PIGTAIL COMPONENT | |
|---|---|
| REF DESIG | LPC PART NO. |
| C4-5 | 2724-140 |
| C7 | 2724-146 |
| C8 | 2724-140 |
| C11 | 2724-146 |
| CR1-2 | 2812-522 |
| R1 | 2635-682 |
| R2 | 2615-335 |
| R3 | 2635-721 |
| R5 | 2651-473 |
| R8 | 2636-534 |




| ORMATION | |
|---|---|
| VALUE | LOC |
| 0.01 | 07 |
| 680 PF | 10 |
| 0.01 | 10 |
| 680 PF | 10 |
| | 01 |
| 16.2K | 04 |
| 1 MEGO | 04 |
| 121K | 02 |
| 10 | 10 |
| 47.5 | 03 |

| | | |
|---|---|---|
| MODEL HSB8B | | T-5653-027 |
| LORAIN PRODUCTS CORPORATION | DWG SIZE D | SHEET 2 |
| | | PRINTED IN U.S.A. |

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  (Includes loads, metering, digital frequency counter)
- Ringing Demand Test Set - Model LS5000
  (measures ring load current and voltage)
- 130V Converter Test Load - Model LS1000
  (Variable loads to 6 amps)

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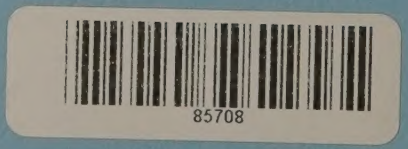
Handy and practical, helps keep down time to a minimum.

**Contact your nearest LORAIN Regional Service Center for more information.**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